

AMENDMENTS TO THE CLAIMS

Claims 1-37 (Canceled)

38. **(Currently amended)** An antenna according to claim 37, wherein An antenna comprising:
an element; and wherein
the element is formed from conductor patterns on a plurality of layers including at
least one buried layer of a multilayer PCB, the PCB is apertured adjacent to
the element, and the conductor patterns are in stacked relation and
interconnected through the PCB.

39. **(Currently amended)** An antenna according to claim 37, including An antenna
comprising:
an element, wherein the element is formed from conductor patterns on a plurality of
layers including at least one buried layer of a multilayer PCB, and the
conductor patterns are in stacked relation and interconnected through the
PCB; and
an antenna ground plane comprising a plurality of vias connecting ground plane
regions on respective PCB layers.

40. (Previously Presented) An antenna according to claim 39, wherein the PCB is
apertured adjacent to the element.

41. (Canceled)

42. (Canceled)

43. (Currently amended) A mobile phone including an antenna disposed therein, said antenna comprising an element formed from conductor patterns on a plurality of layers including at least one buried layer of a multilayer PCB, wherein the conductor patterns are in stacked relation and interconnected through the PCB.
44. (Previously Presented) A mobile phone according to claim 43, wherein the PCB is apertured adjacent to the element.
45. (Previously Presented) A mobile phone according to claim 43, including an antenna ground plane comprising a plurality of vias connecting ground plane regions on respective PCB layers.
46. (Previously Presented) A mobile phone according to claim 45, wherein the PCB is apertured adjacent to the element.
47. (Previously Presented) A mobile phone in accordance with claim 43 wherein interconnection of the conductor patterns is from the conductor patterns through the at least one buried layer.
48. (Previously Presented) A mobile phone in accordance with claim 47 wherein the interconnection is by vias extending through the at least one buried layer of the PCB.
49. (Previously presented) An antenna structure, comprising:
 - a substrate having a footprint;
 - an antenna trace having a perimeter formed on a face of said substrate proximate a ground plane of said substrate and said perimeter being substantially co-

planar with said face, wherein said substrate has a predetermined radio frequency loss associated therewith; and

a low-loss region extending through said substrate, wherein said low-loss region is an opening located within said footprint that extends transverse to and intersects a plane of said face, and said low-loss region located between said antenna trace and said ground plane, wherein said low-loss region has a radio frequency loss less than said radio frequency loss associated with said substrate, and wherein said low-loss region is located outside of said perimeter of said antenna trace.

50. (Previously presented) The antenna structure recited in claim 49 further including a plurality of said low-loss regions.

51. (Previously presented) The antenna structure recited in claim 50 wherein each of said low-loss regions is separated by a portion of said substrate.

52. (Previously presented) The antenna structure recited in claim 49 wherein said low-loss region comprises air.

53. (Previously presented) The antenna structure recited in claim 49 wherein said antenna trace includes antenna traces located on opposing surfaces of said substrate and connected by a via.

54. (Previously presented) The antenna structure recited in claim 49 wherein said substrate is comprised of a high loss material.

55. (Previously presented) A method of manufacturing an antenna structure, comprising:

forming an antenna trace having a perimeter formed on a face of a substrate having a footprint proximate a ground plane of said substrate and said perimeter being substantially co-planar with said face, wherein said substrate has a predetermined radio frequency loss associated therewith; and creating a low-loss region extending through said substrate and located between said antenna trace and said ground plane, wherein said low-loss region is an opening located within said footprint that extends transverse to and intersects a plane of said face, and wherein said low-loss region has a radio frequency loss less than said radio frequency loss associated with said substrate, and wherein said low-loss region is located outside said perimeter of said antenna trace.

56. (Previously presented) The method recited in claim 55 wherein said creating includes creating a plurality of low-loss regions.
57. (Previously presented) The method recited in claim 55 wherein said creating includes creating a plurality of low-loss regions separated by a portion of said substrate.
58. (Previously presented) The method recited in claim 55 wherein said substrate is comprised of a high-loss material.
59. (Previously presented) The method recited in claim 55 wherein said creating includes creating a low-loss region comprising air.

60. (Previously presented) The method recited in claim 55 wherein said forming includes forming antenna traces located on opposing surfaces of said substrate interconnected by a via extending through said substrate.
61. (Previously presented) A printed circuit board (PCB), comprising:
 - a substrate having a footprint and a ground plane and conductive traces formed thereon, wherein said substrate has a predetermined radio frequency loss associated therewith; and
 - an antenna structure, including:
 - an antenna trace having a perimeter formed on a face of a substrate proximate a ground plane of said substrate and said perimeter being substantially coplanar with said face, wherein said substrate has a predetermined radio frequency loss associated therewith; and
 - a low-loss region extending through said substrate and located between said antenna trace and said ground plane, wherein said low-loss region is an opening located within said footprint that extends transverse to and intersects said face, and wherein said low-loss region has a radio frequency loss less than said radio frequency loss associated with said substrate, and wherein said low-loss region is located outside said perimeter of said antenna trace.
62. (Previously presented) The PCB recited in claim 61 wherein said substrate is comprised of a high-loss material.

63. (Previously presented) The PCB recited in claim 61 wherein said low-loss region includes a plurality of low-loss regions separated by a portion of said substrate.
64. (Previously presented) The PCB recited in claim 61 wherein said substrate has a footprint, and said low-loss region is an opening located within a said footprint of said substrate.
65. (Previously presented) The PCB recited in claim 64 wherein said low-loss region includes a low-loss material comprising air.
66. (Previously presented) The PCB recited in claim 61 wherein said antenna trace includes antenna traces located on opposing surfaces of said substrate interconnected by a via extending through said substrate.
67. (Previously presented) An antenna structure, comprising:
 - an antenna trace formed on a substrate proximate a ground plane of said substrate, wherein said substrate has a footprint and a predetermined radio frequency loss associated therewith; and
 - a low-loss region extending through said substrate and located between said antenna trace and said ground plane, wherein said low-loss region is an opening located within said footprint that extends transverse to and intersects a plane of said face, and wherein said low-loss region has a radio frequency loss less than said radio frequency loss associated with said substrate, and said antenna trace does not overlap said low-loss region.
68. (Previously presented) An antenna structure, comprising:
 - a planar antenna trace formed on a substrate;

a ground plane formed on said substrate, wherein a plane of said substrate on which said planar antenna is located is co-planar or parallel with a plane of said substrate on which said ground plane is located, and said ground plane is non-overlapping with said planar antenna trace; and
an insulation region extending through said substrate and located between said planar antenna trace and said ground plane.

69. (Previously presented) The antenna structure recited in claim 68, wherein said planar antenna trace is a first planar antenna trace and said antenna structure further includes a second planar antenna trace located on an opposing, parallel surface of said substrate and said first and second planar antenna traces are interconnected by a via extending through said substrate.
70. (Previously presented) The antenna structure recited in claim 68 wherein said insulation region includes a plurality of insulation regions.
71. (Previously presented) The antenna structure recited in claim 70 wherein each of said insulation regions are separated by a portion of said substrate.
72. (Previously presented) The antenna structure recited in claim 68 wherein said insulation region is an opening that extends through said substrate and an insulator of said insulation region is air.
73. (Previously presented) The antenna structure recited in claim 68 wherein said substrate is a lossy substrate.
74. (Previously presented) A method of manufacturing an antenna structure, comprising:

forming planar antenna trace on a substrate;
forming a ground plane on said substrate, wherein a plane of said substrate on
which said planar antenna is located is co-planar or parallel with a plane of
said substrate on which said ground plane is located, and said ground plane
is non-overlapping with said planar antenna trace; and
creating an insulation region extending through said substrate and located between
said planar antenna trace and said ground plane.

75. (Previously presented) The method recited in claim 74, wherein said planar antenna trace is a first planar antenna trace and said antenna structure further includes a second planar antenna trace located on an opposing, parallel surface of said substrate and said first and second planar antenna traces are interconnected by a via extending through said substrate.
76. (Previously presented) The method recited in claim 74, wherein said creating includes creating a plurality of insulation regions.
77. (Previously presented) The method recited in claim 74, wherein said creating a plurality of insulation regions includes creating a plurality of insulation regions separated by a portion of said substrate.
78. (Previously presented) The method recited in claim 74, wherein said creating an insulation region includes creating an opening that extends through said substrate and wherein an insulator of said insulation region is air.

79. (Previously presented) The method recited in claim 74, wherein said forming includes forming antenna traces located on opposing surfaces of said substrate interconnected by a via extending through said substrate.
80. (Previously presented) A printed circuit board (PCB), comprising,
 - a substrate having
 - a ground plane and conductive traces formed thereon; and
 - a planar antenna structure, including: an antenna trace formed on said substrate; said planar ground plane formed on said substrate, wherein a plane of said substrate on which said planar antenna is located is co-planar or parallel with a plane of said substrate on which said ground plane is located, and said ground plane is non-overlapping with said antenna trace; and
 - an insulation region extending through said substrate and located between said antenna trace and said ground plane.
81. (Previously presented) The PCB recited in claim 80, wherein said planar antenna trace is a first planar antenna trace and said antenna structure further includes a second planar antenna trace located on an opposing, parallel surface of said substrate and said first and second planar antenna traces are interconnected by a via extending through said substrate.
82. (Previously presented) The PCB recited in claim 80, further including electrical components mounted on said substrate and interconnected between at least one of said conductive traces and said ground plane to form an operative circuit.

83. (Previously presented) The PCB recited in claim 80, wherein said insulation region includes a plurality of insulation regions separated by a portion of said substrate.
84. (Previously presented) The PCB recited in claim 80, wherein said insulation region is an opening that extends through said substrate and an insulator of said insulation region is air.
85. (Previously presented) An antenna structure, comprising:
 - an antenna substrate having a planar surface, said antenna substrate having a predetermined radio frequency loss associated therewith;
 - a planar antenna trace formed on said planar surface and extending along and adjacent an edge of said planar surface;
 - a ground plane formed on said antenna substrate, wherein said ground plane is non-overlapping with said planar antenna trace; and
 - a low-loss region located between said planar antenna trace and said ground plane, said low-loss region having a longitudinal axis extending along only a portion of and adjacent said edge, and having a radio frequency loss less than said predetermined radio frequency loss.
86. (Previously presented) The antenna structure recited in claim 85, wherein said low-loss region is non-overlapping with said planar antenna trace.
87. (Previously presented) The antenna structure recited in claim 86, wherein said ground plane is a planar ground plane and is located on said planar surface and is co-planar with said planar antenna trace.

88. (Previously presented) The antenna structure recited in claim 85 further including a plurality of said low-loss regions, wherein each of said low-loss regions is separated by a portion of said substrate and each of said plurality is non-overlapping with said planar antenna trace.
89. (Previously presented) The antenna structure recited in claim 85 wherein said low-loss region comprises air.
90. (Previously presented) The antenna structure recited in claim 85 wherein said planar antenna trace comprises a first portion that extends in one direction along said edge and a second portion that extends in an opposite direction along said edge.
91. (Previously presented) The antenna structure recited in claim 85 wherein said low-loss region is an opening that extends through a thickness of said substrate.
92. (Previously presented) A method of manufacturing an antenna structure, comprising:
 - providing an antenna substrate having a planar surface, said antenna substrate having a predetermined radio frequency loss associated therewith,
 - forming a planar antenna trace on said planar surface along and adjacent an edge of said planar surface,
 - placing a ground plane on said antenna substrate, wherein said ground plane is non-overlapping with said planar antenna trace; and
 - creating a low-loss region between said planar antenna trace and said ground plane, said low-loss region having a longitudinal axis extending along only a

portion of and adjacent said edge, said low-loss region having a radio frequency loss less than said predetermined radio frequency loss.

93. (Previously presented) The method recited in claim 92, wherein said low-loss region is non-overlapping with said planar antenna trace.
94. (Previously presented) The method recited in claim 92, wherein said ground plane is a planar ground plane formed on said planar surface and co-planar with said planer antenna trace.
95. (Previously presented) The method recited in claim 92 wherein said creating includes creating a plurality of low-loss regions, wherein each of said low-loss regions is separated by a portion of said substrate and each of said plurality is non-overlapping with said planar antenna trace.
96. (Previously presented) The method recited in claim 92 wherein said creating includes creating a low-loss region comprising air.
97. (Previously presented) The method recited in claim 92 wherein said forming includes forming first and second portions of said planar antenna trace where said first portion extends in one direction along said edge and the second portion extends in an opposite direction along said edge.
98. (Previously presented) The method recited in claim 92 wherein said creating said low-loss region comprises forming an opening that extends through a thickness of said substrate.
99. (New) A mobile phone including an antenna structure disposed therein, said antenna structure comprising:

an antenna trace formed on a substrate that is disposed within said mobile phone,
said antenna trace proximate a ground plane of said substrate, wherein said
antenna trace includes antenna traces located on opposing surfaces of said
substrate interconnected by vias extending through said substrate; and
an insulation region extending through said substrate and located between said
antenna trace and said ground plane.

100. (New) The mobile phone of claim 99, wherein said insulation region includes a plurality of insulation regions.
101. (New) The mobile phone of claim 100, wherein each of said insulation regions are separated by a portion of said substrate.
102. (New) The mobile phone of claim 99, wherein said insulation region is an opening that extends through said substrate and an insulator of said insulation region is air.
103. (New) The mobile phone of claim 99, wherein said substrate is a lossy substrate.
104. (New) A method of manufacturing a mobile phone including an antenna structure disposed therein, comprising:
forming an antenna trace on a substrate proximate a ground plane of said substrate,
wherein said forming includes forming antenna traces located on opposing
surfaces of said substrate interconnected by vias extending through said
substrate;
creating an insulation region extending through said substrate and located between
said antenna trace and said ground plane; and
disposing said substrate within said mobile phone.

105. (New) The method recited in claim 104, wherein said creating includes creating a plurality of insulation regions.
106. (New) The method recited in claim 104, wherein said creating a plurality of insulation regions includes creating a plurality of insulation regions separated by a portion of said substrate.
107. (New) The method recited in claim 104, wherein said creating an insulation region includes creating an opening that extends through said substrate and wherein an insulator of said insulation region is air.
108. (New) The method recited in claim 107, wherein said creating an opening includes cutting a slot in said substrate.
109. (New) A mobile phone including a printed circuit board (PCB) disposed therein, said PCB comprising:
 - a substrate disposed within said mobile phone and having a ground plane and conductive traces formed thereon; and
 - an antenna structure, including:
 - an antenna trace formed on said substrate proximate said ground plane, wherein said antenna trace includes antenna traces located on opposing surfaces of said substrate interconnected by vias extending through said substrate; and
 - an insulation region extending through said substrate and located between said antenna trace and said ground plane.
110. (New) The mobile phone recited in claim 109 wherein said insulation region includes a plurality of insulation regions separated by a portion of said substrate.

111. (New) The mobile phone recited in claim 109, wherein said insulation region is an opening that extends through said substrate and an insulator of said insulation region is air.
112. (New) A mobile phone including a printed circuit board (PCB) disposed therein, said PCB having an antenna structure formed on a substrate, the antenna structure comprising:
an antenna trace formed on said substrate, wherein said substrate is disposed within said mobile phone and is a lossy substrate, and wherein said antenna trace includes antenna traces located on opposing surfaces of said substrate interconnected by vias extending through said substrate; and an insulation region extending through said substrate.
113. (New) The mobile phone recited in claim 112, wherein said insulation region includes a plurality of insulation regions.
114. (New) The mobile phone recited in claim 113, wherein each of said insulation regions are separated by a portion of said substrate.
115. (New) The mobile phone recited in claim 112, wherein said insulation region is an opening that extends through said substrate and an insulator of said insulation region is air.
116. (New) A mobile phone including a printed circuit board (PCB) disposed therein, said PCB comprising:
a substrate disposed within said mobile phone and having a ground plane;
a first antenna trace formed on a face of said substrate;

a second antenna trace formed on an opposing face of said substrate; and
a plurality of electrically conductive vias through said substrate, said plurality of
vias coupling said first antenna trace to said second antenna trace.

117. (New) The mobile phone as recited in claim 116, wherein an insulation region is formed between said first and second antenna traces and said ground plane.
118. (New) The mobile phone as recited in claim 116, wherein substrate is a lossy substrate.